We claim:

1. An isolated nucleic acid which hybridizes under stringent conditions to a nucleotide sequence designated in SEQ ID NO. 1.

2. An isolated nucleic acid which hybridizes under stringent conditions to a nucleotide sequence designated in SEQ. ID. NO. 3.

3. An isolated nucleic acid which hybridizes under stringent conditions to a nucleotide sequence designated in SEQ. ID. NO. 5.

4. An isolated nucleic acid encoding an *HDx* polypeptide which polypeptide comprises at least one ν motif designated in the formula:

5. The isolated nucleic acid of claim 4, which polypeptide comprises two ν motifs.

6. The isolated nucleic acid of claim 4, which polypeptide comprises a ν motif designated in SEQ. ID. No. 8.

7. The isolated nucleic acid of claim 4, which polypeptide comprises a ν motif designated in SEQ. ID. No. 9.

8. The isolated nucleic acid of claim 4, which polypeptide comprises a ν motif designated in SEQ. ID. No. 10.

9. An isolated nucleic acid encoding an *HDx* polypeptide, which *HDx* polypeptide comprises a polypeptide sequence at least 88% identical with SEQ. ID. No. 2, or fragment thereof.

10. An isolated nucleic acid encoding an *HDx* polypeptide, which *HDx* polypeptide comprises a polypeptide sequence at least 95% identical with SEQ. ID. No. 2, or fragment thereof.

11. An isolated nucleic acid encoding an *HDx* polypeptide, which *HDx* polypeptide comprises a polypeptide sequence at least 88% identical with SEQ. ID. No. 4, or fragment thereof.

12. An isolated nucleic acid encoding an *HDx* polypeptide, which *HDx* polypeptide comprise a polypeptide sequence at least 95% identical with SEQ. ID. No. 4, or frragment thereof.

13. An isolated nucleic acid encoding an *HDx* polypeptide, which *HDx* polypeptide comprises a polypeptide sequence at least 88% identical with SEQ. ID. No. 6, or fragment thereof.

14. An isolated nucleic acid encoding an *HDx* polypeptide, which *HDx* polypeptide comprises a polypeptide sequence at least 95% identical with SEQ. ID. No. 6, or fragment thereof.

15. An isolated nucleic acid encoding an *HDx* polypeptide, which *HDx* polypeptide comprises a polypeptide sequence designated in SEQ ID. No. 2.

16. An isolated nucleic acid encoding an *HDx* polypeptide, which *HDx* polypeptide comprises a polypeptide sequence designated in SEQ. ID. No. 4.

17. An isolated nucleic acid encoding an *HDx* polypeptide, which *HDx* polypeptide comprises a polypeptide sequence designated in SEQ. ID. No. 6.

18. The nucleic acid of claims 15, 16, or 17, which *HDx* polypeptide has a molecular weight in the range of 40kD to 90KD.

19. The nucleic acid of any one of claims 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16 or 17, which *HDx* polypeptide is a fusion protein further comprising, in addition to *HDx* polypeptide sequences, a second polypeptide sequence having an amino acid sequence unrelated to a nucleic acid sequence.

20. The nucleic acid of claim 19, wherein said fusion protein includes, as a second polypeptide sequence, a polypeptide which functions as a detectable label for detecting the presence of said fusion protein or as a matrix-binding domain for immobilizing said fusion protein.

21. The nucleic acid of any one of claims 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, or 17, further comprising a transcriptional regulatory sequence operably linked to said nucleotide sequence so as to render said nucleic acid suitable for use as an expression vector.

22. An expression vector, capable of replicating in at least one of a prokaryotic cell and eukaryotic cell, comprising the nucleic acid of claim 21.

23. A host cell transfected with the expression vector of claim 22 and expressing said recombinant polypeptide.

24. A method of producing a recombinant *HDx* polypeptide comprising culturing the cell of claim 23 in a cell culture medium to express said recombinant polypeptide and isolating said recombinant polypeptide from said cell culture.

25. A transgenic non-human animal having cells which harbor a heterologous transgene encoding an *HDx* polypeptide of any one of SEQ ID. Nos. 2, 4, 6, 7, 8, 9, or 10.

26. A transgenic non-human animal having cells in which an *HDx* gene of any one of SEQ ID. Nos. 1, 3 or 5, is disrupted.

27. A recombinant transfection system comprising:

(i) a gene construct including the nucleic acid represented in any one of SEQ. ID. Nos. 1, 3, or 5 and operably linked to a transcriptional regulatory sequence for causing expression of said *HDx* polypeptide in eukaryotic cells, and

(ii) a gene delivery composition for delivering said gene construct to a cell and causing the cell to be transfected with said gene construct.

28. The recombinant transfection system of claim 27, wherein the gene delivery composition is selected from the group consisting of a recombinant viral particle, a liposome, and a polycationic nucleic acid binding agent.

29. A nucleic acid composition comprising a substantially purified oligonucleotide, said oligonucleotide including a region of nucleotide sequence which hybridizes under stringent conditions to at least 25 consecutive nucleotides of sense or antisense sequence of an *HDx* gene.

30. The nucleic acid composition of claim 29, which oligonucleotide hybridizes under stringent conditions to at least 50 consecutive nucleotides of sense or antisense sequence of an *HDx* gene.

31. The nucleic acid composition of claim 29, wherein said oligonucleotide further comprises a label group attached thereto and able to be detected.

32. The nucleic acid compsotion of claim 29, wherein said oligonucleotide has at least one non-hydrolyzable bond between two adjacent nucleotide subunits.

33. A test kit for detecting cells which contain an *HDx*-encoding nucleic acid, comprising the nucleic acid composition of claim 29 for measuring, in a sample of cells, a level of nucleic acid encoding an *HDx* protein.

34. An antibody to an *HDx* polypeptide, wherein said *HDx* polypeptide is at least 88% identical to any one of SEQ. ID. Nos. 2, 4 or 6.

35. An antibody to an *HDx* polypeptide, wherein said *HDx* polypeptide contains a χ motif represented in any one of SEQ. ID. Nos. 7, 8, 9, or 10.

36. The antibody of claim 34 or 35, wherein said antibody is monoclonal.

37. An isolated or recombinant polypeptide, which polypeptide comprises an *HDx* polypeptide sequence at least 88 percent identical to SEQ ID No: 2, or fragment thereof.

38. The polypeptide of claim 24, which polypeptide is encoded by a nucleic acid having a coding sequence, or portion thereof, which hybridizes under stringent conditions to the nucleic acid sequence designated in SEQ. ID. No. 1.

39. The polypeptide of claim 24, which polypeptide comprises an *HDx* polypeptide sequence at least 95 percent identical to SEQ ID No: 2, or fragment thereof.

40. The polypeptide of claim 24, which polypeptide comprises an *HDx* polypeptide sequence identical to SEQ ID No. 2.

41. The polypeptid of claim 24, which polypeptide is of mammalian origin.

42. The polypeptide of claim 24, which polypeptide is of human origin.

43. An isolated or recominant polypeptide, which polypeptide comprises an *HDx* polypeptide sequence at least 88% identical to SEQ ID. No. 4, or fragment thereof.

44. The polypeptide of claim 30, which polypeptide is encoded by a nucleic acid having a coding sequence, or portion thereof, which hybridizes under stringent conditions to the nucleic acid designated in SEQ. ID. No. 3.

45. The polypeptide of claim 30, which polypeptide is at least 95% identical to SEQ. ID. No. 4, or fragment thereof.

46. The polypeptide of claim 30, which polypeptide is identical to SEQ. ID. No. 4.

47. The polypeptide of claim 30, which polypeptide is of mammalian origin.

48. The polypeptide of claim 30, which polypeptide is of human origin.

49. An isolated or recombinant polypeptide, which polypeptide is at least 88% identical to SEQ. ID. No. 6.

50. The polypeptide of claim 36, which polypeptide is encoded by a nucleic acid having a coding sequence, or portion thereof, which hybridizes under stringent conditions to the nucleic acid sequence designated in SEQ. ID. No. 5.

51. The polypeptide of claim 36, which polypeptide is at least 95% identical to SEQ. ID. No. 6.

52. The polypeptide of claim 36, which polypeptide is identical to SEQ. ID. No. 6.

53. The polypeptide of claim 36, which polypeptide is of mammalian origin.

54. The polypeptide of claim 36, which polypeptide is of human origin.

55. The polypeptide of claim 24, 30 or 36, which polypeptide is an acetylase activity.

56. The polypeptide of claim 24, 30 or 36, which polypeptide binds to a histone, a 14-3-3 protein, a MEF2 transcription factor, a retinoblastoma associtated protein such as RbAp48.

57. The polypeptide of claim 24, 30 or 36, which polypeptide is fusion protein.

58. The polypeptide of claim 24, 30 or 36, which polypeptide has a molecular weight in the range of 80 kDa to 150 kDa.

59. An isolated or recombinant polypeptide, which polypeptide comprises an *HDx* sequence represented in SEQ. ID. No. 7.

60. An isolated or recombinant polypeptide, which polypeptide comprises an *HDx* sequence represented in SEQ. ID. No. 8,

61. An isolated or recombinant polypeptide, which polypeptide comprises an *HDx* sequence represented in SEQ. ID. No. 9.

62. An isolated or recombinant polypeptide, which polypeptide comprises an *HDx* sequence represented in SEQ. ID. No. 10.

63. The polypeptide of any one of claims 46, 47, 48, or 49, which polypeptide retains one or more of a histone deacetylase activity, or a histone binding activity.

64. The polypeptide of any one of claims 46, 47, 48, or 49, which polypeptide deacetylates acetylated histones.

65. The polypeptide of any one of claims 46, 47, 48 or 49, which polypeptide is a dominant negative inhibitor which antagonizes deacetylation of acetylated histones.

66. The polypeptide of any one of claims 46, 47, 48, or 49, which polypeptide modulates cellular proliferation.

67. A method for modulating one or more of growth, differentiation, or survival of a marnmalian cell responsive to HDx-mediated histone deacetylation, comprising treating the cell with an effective amount of an agent which modulates the deacetylase activity of a class II HDAC polypeptide thereby altering, relative to the cell in the absence of the agent, at least one of (i) rate of growth, (ii) diffierentiation, or (iii) survival of the cell.

68. The method of claim 67, wherein the class II HDAC polypeptide is encoded by a nucleic acid that hybridizes under stringent condtions to the nucleic acid of SEQ ID Nos. 1, 3 or 5.

69. An assay for screening test compounds to identify agents which inhibit the deacetylation of histones comprising:

i. providing a reaction mixture including a histone deacetylase activity of an HDx-like polypeptide encoded by a nucleic acid that hybridizes under stringent condtions to the nucleic acid of SEQ ID Nos. 1, 3 or 5, and a test compound; and

ii. detecting the conversion of the substrate to product,

wherein a statistically signficant decrease in the conversion of the substrate in the presence of the test compound is indicative of a potential inhibitor of histone deacetylation.

70. An assay for screening test compounds to identify agents which inhibit the deacetylation of histones comprising:

i. providing a reaction mixture including a tagged class II HDAC polypeptide encoded by a nucleic acid that hybridizes under stringent condtions to the nucleic acid of SEQ ID Nos. 1, 3 or 5, and a spatially segregated combinatorial small molecule library; and

ii. detecting the presence of the tagged class II HDAC polypeptide bound at a specific position of the spatially segregated combinatorial small molecule library, wherein the position indicates the identity of the small molecule inhibitor,

thereby identifying an agent which inhibits the deacetylation of histones.

71. An assay for screening test compounds to identify agents which inhibit histone deacetylase interaction with cellular proteins, comprising:

i. providing a reaction mixture including a class II HDAC polypeptide encoded by a nucleic acid that hybridizes under stringent condtions to the nucleic acid of SEQ ID Nos. 1, 3 or 5, an HDx binding protein, and a test compound; and

ii. detecting the interaction of the HDx-like protein and the HDx binding protein, wherein a statistically signficant decrease in the interaction of the proteins in the presence of the test compound is indicative of a potential inhibiton of a histone deacetylase.

72. A composition for inhibiting a class II histone deacetylase comprising a compound represented by the general formula A-B-C, wherein A is selected from the group consisting of cycloalkyls, unsubstituted and substituted aryls, heterocyclyls, amino acyls, and cyclopeptides; B is selected from the group consisting of substituted and unsubstituted C4-C8 alkylidenes, C4-C8 alkenylidenes, C4-C8 alkynylidenes, and -(D-E F)-, in which D and F are, independently, absent or represent a C2-C7 alkylidene, a C2 C7 alkenylidene or a C2-C7 alkynylidene, and E represents 0, S, or NK, in which X represents H, a l ower alkyl, a lower alkenyl, a lower alkynyi, an aralkyl, aryl, or a heterocyclyl; and C is selected from the group consisting of Y 0 H ~lp ~,R7 N,' p ,R7 0 U 0 0 and a boronic acid; in which Z represents 0, S, or NRS, and Y; RS represents a hydrogen, an alkyl, an alkoxycarbonyl, an aryloxycarbonyl, an alkylsulfonyl, an

arylsulfonyl or an aryl; W6 represents hydrogen, an alkyl, an alkenyl, an alkynyl or an aryl; and R7 represents a hydrogen, an alkyl, an aryl, an alkoxy, an aryloxy, an an dno, a hydroxylamino, an alkoxylarnino or a halogen; with the proviso that the compound is not trapoxin.

73. A pharmaceutical preparation comprising (i) the composition of claim 72 in an amount effective for inhibiting proliferation of a cell, and (ii) a pharmaceutically acceptable diluent.

74. A combinatorial library of compounds comprising a small molecule inhibitor of a class II histone deacetylase, said library comprising a plurality of compounds represented by a structure #1, #2, or #3 of Figure 18A, or the structure represented in Figure 18B.

75. The combinatorial library of claim 74, wherein said compounds are spatially segregated.

76. A composition for inhibiting a class II histone deacetylase comprising a compound represented by the general formula A-B-C, wherein A is selected from the group consisting of cycloalkyls, unsubstituted and substituted aryls, heterocyclyls, amino acyls, and cyclopeptides; B is selected from the group consisting of substituted and unsubstituted C4-C8 alkylidenes, C4-C8 alkenylidenes, C4-C8 alkynylidenes, and ~(D-E F)-, in which D and F are ' independently, absent or represent C2-C7 alkylidenes, C2-C7 alkenylidenes or C2-C7 alleynylidenes, and E represents 0, S, or NW, in which R! represents H, a lower alky], a lower alkenyl, a lower alkynyl, an aralkyl, an aryl, or a heterocyclyl; and C is selected ftom the groupconsisting of Y Y 0 ,,0H j., ',NH2 - R-Rg J~N N 11 H H 0 in which R9 represents a hydrogen, an alkyl, an aryl, a hydroxyl, an alkoxy, an aryloxy or an amino, with the proviso that the inhibitor compound is not trichostatin.

77. A composition for inhibiting a class II histone deacetylase comprising a compound represented by the general formula A-B-C, wherein A is selected from the group consisting of cycloalkyls, unsubstituted and substituted aryls, heterocyclyls, amino acyls, and cyclopeptides; B is selected from the group consisting of substituted and unsubstituted C4-C8 alkylidenes, C4-Cg alkenylidenes, C4-C8 alkynylidenes, and -(D-E F)-, in which D and F are, independently, absent or a C2-C7 alkylidene, a C2-C7 alkenylidene, or a C2-C7 alkynylidene, and E represents 0, S, or NIC, in which X is H, lower alkyl, lower alkenyl, lower a"yi, aralkyl, aryl, or heterocyclyl; and C represents J~ R7 ; in which Y is 0 or S, and R7 represents a hydrogen, an alkyl, an aryl, an alkoxy, an aryloxy, an amino, a hydroxylarnino, an alkoxylarnino or a halogen.